

# **TOPIC 04 – BONDING**

## **4.4 – METALLIC BONDING**

IB Chemistry  
T04D06



# Metallic Bonding

- 4.4.1 Describe the metallic bond as the electrostatic attraction between a lattice of positive ions and delocalized electrons. (2)
- 4.4.2 Explain the electrical conductivity and malleability of metals. (3)



## 4.4

# What is a Metallic Bond?

4.4.1 Describe the metallic bond as the electrostatic attraction between a lattice of positive ions and delocalized electrons. (2)

- In metals, the valence electrons are no longer associated with any particular atom/nucleus but are free to move throughout the metal
- These mobile electrons are known as **delocalized electrons** and exist in a “sea of electrons” which are “shared” by each metal in the lattice
- In order for this to happen, metals are ionized, becoming cationic
- **Metallic Bonding** is defined as the electrostatic attraction between the metal ions and delocalized electrons
- Metallic bonding is non-directional – where all of the valence electrons are attracted to the nuclei of the metal ions.

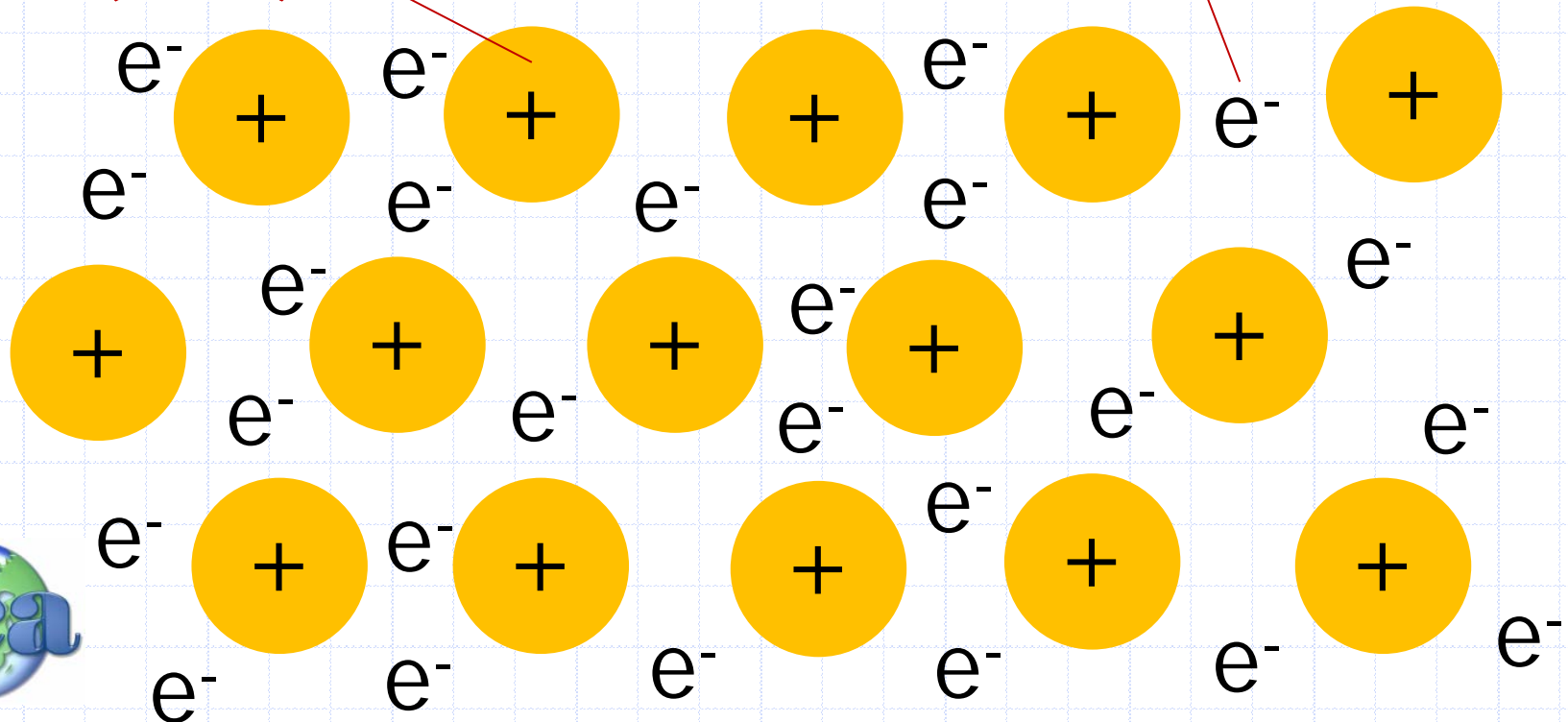


# Metallic Bonding Diagram

- The delocalized electrons form a “sea of electrons”
- The electrons are constantly in motion

Nuclei and inner-shell electrons (cations)

Delocalized outer-shell electrons



# Properties of Metals

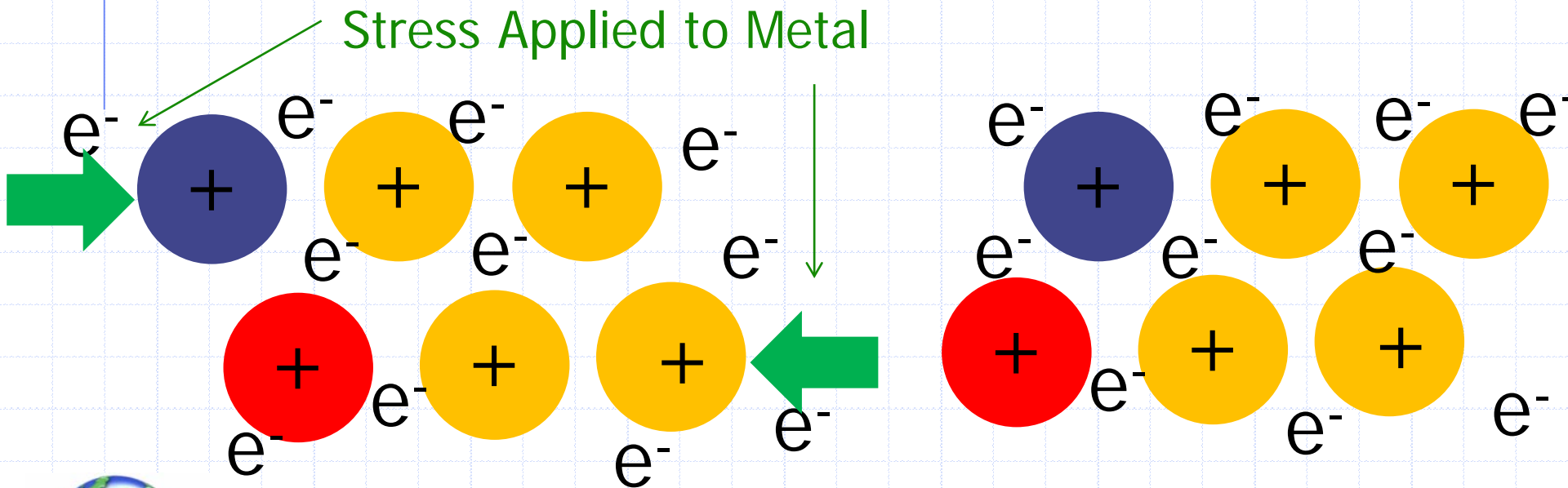
## 4.4.2 Explain the electrical conductivity and malleability of metals. (3)

- Metals are known to be both ductile and malleable and are excellent conductors of heat and electricity
  - **Ductile:** The ability of metals to be drawn out under tension and stretched into wires
  - **Malleable:** The ability of metals to be bent and beaten into thin sheets without breaking
  - **Conductivity:** Mobile electrons allow for the transfer of both heat and electricity with limited resistance



# Lateral Movement of Layers

- Since the valence electrons in a metal do not belong to any particular atom, if sufficient force is applied to the metal, one layer of atoms can slide over another without disrupting the metallic bonding



If other elements are added to the metal, forming an alloy, the layers will not slide as easily and as a result are less malleable and ductile



# Conductivity of Metals

- When a voltage (potential difference) is applied across a metal, the electrons respond to the positive and negative electrodes
- A flow of electrons results
- Due to delocalized electrons!!

